The Burden of Infectious Disease Among Inmates of and Releasees From US Correctional Facilities, 1997

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Objectives. This study developed national estimates of the burden of selected infectious diseases among correctional inmates and releasees during 1997.

Methods. Data from surveys, surveillance, and other reports were synthesized to develop these estimates.

Results. During 1997, 20% to 26% of all people living with HIV in the United States, 29% to 43% of all those infected with the hepatitis C virus, and 40% of all those who had tuberculosis disease in that year passed through a correctional facility.

Conclusions. Correctional facilities are critical settings for the efficient delivery of prevention and treatment interventions for infectious diseases. Such interventions stand to benefit not only inmates, their families, and partners, but also the public health of the communities to which inmates return. (*Am J Public Health.* 2002;92:1789–1794)

Although some figures have been published,[1–3] comprehensive statistics demonstrating the burden of infectious disease among inmates have been lacking. An important "public health opportunity" in prisons and jails has been identified by some authors.[4–7] This opportunity has yet to be fully exploited for various reasons, including a lack of statistics as well as the fact that prisoners are generally marginalized, despised, and politically impotent. Political leaders and the public have not recognized the importance of correctional settings for health interventions. Prevention and treatment programs are extremely uneven in quality and quantity and, in some respects, fundamentally inadequate.[1,8]

This article presents national estimates for 1997 of inmates and releasees with HIV infection (non-AIDS) and AIDS, hepatitis C virus (HCV) infection, and tuberculosis (TB) disease and the proportions of the total burden of these conditions found among people who passed through US correctional facilities in that year. We selected these conditions for this study because they offered the best data for developing national estimates, and we chose 1997 because it was the most recent year for which data were available. The presentation of these estimates is intended to help make a case for expanded and improved prevention and treatment interventions in prisons and jails.[9]

METHODS

In this study we developed national estimates of the prevalence of selected infectious diseases among prison and jail inmates during 1997, then applied these percentages to the number of persons incarcerated on June 30, 1997, to estimate the number of inmates with each condition. Next, we applied the prevalence percentages for inmates to the total number of people released from correctional facilities during 1997 to yield an estimate of the number of releasees with each condition. Finally, we calculated the percentages of the total number of people with these conditions in the United States found among correctional releasees in 1997. Below, we describe the methods used to develop each of the components used in these national estimates.

Number of Correctional Facility Inmates and Releasees

The 1997 figures on state and federal prison populations and city and county jail populations come from surveys conducted by the Bureau of Justice Statistics (BJS). We used BJS midyear 1997 prison and jail inmate statistics as well as data on all 1997 prison releases[10,11] The BJS figure on prison releases—528 848—represents a reasonable estimate of the number of *different* people released from prisons, because average length of stay in prison systems is about 2 years.

It was also necessary to estimate the number of *unique* individuals released from jails during 1997. This estimate was based on a statistical model of the frequency of arrests. The only data available for such a model came from a special 1995 addendum to the Drug Use Forecasting (DUF) survey conducted by the National Institute of Justice (NIJ). The DUF survey, administered in 6 sites, provided data about recent arrests for a sample of arrestees who were weekly or more frequent heroin and cocaine users. Given that a negative binomial process generates arrests, this sample averaged about 0.38 arrests per year at liberty. (Ongoing analysis of data from 37 different cities suggests that an average of 0.38 arrests per year is broadly representative of this group of drug users nationally.) This figure implies that N/1.38 unique individuals among a total of N weekly drug users are arrested during a year. In a steady state, the number of arrests will roughly equal the number of jail releases. The most recent BJS estimate of jail releases is 10 million in the year 1993.[12] By this logic, 10 million total releases represents 7.2 million (10/1.38) different individuals released from jail in 1993. Admittedly, among the universe of arrestees, regular drug users tend to be arrested more frequently, but the use of an overstated arrest frequency would, if anything, yield an underestimate of different releasees and thus an underestimate of the number of releasees with a given infectious disease. In short, the use of the data on arrest frequency among drug users results in more conservative estimates of the burden of disease among releasees.

Data Sources and Estimation of AIDS and HIV Infection (Non-AIDS)

AIDS. The BJS conducts surveys that gather statistics on the numbers of inmates with AIDS and with HIV infection. We used these data to calculate the number of inmates with HIV who have not yet progressed to AIDS. We used the 1997 year-end BJS prevalence percentage (0.5%) for state/federal prison inmates with AIDS.[3] Four states did not report to the 1997 BJS survey: for Maine and Virginia, the figures reported to BJS for 1996 were used, and for Delaware and Indiana, the average of the figures submitted by the other states in the region was employed.

The BJS prevalence estimate for state/federal prison inmates with AIDS was applied to city/county jail inmates. This approach seems reasonable, given the similarities in these populations. According to BJS statistics,[11,13] these populations are quite similar in terms of demographics: sex (jails: 90% males; state prisons: 94%), race/ethnicity (jails: White, 37%; Black, 41%, and Latino, 19%; state prisons: 33%, 47%, and 17%, respectively), and age distribution (jails: aged 18 years or younger, 18%; 25–34 years, 37%; 35–44 years, 24%; and 45 years or older, 9%; state prisons: 20%, 38%, 29%, and 13%, respectively). These populations also are similar in most offense categories for which inmates are incarcerated—property offenses (27%, 22%) and drug offenses (22%, 21%) in jails and in state prisons, respectively—although the percentage of inmates incarcerated for violent offenses is substantially higher in state prisons (47%) than in jails (26%). Most jail inmates (73%) and prison inmates (75%) have prior criminal records. Most members of both populations have histories of drug use (82% in jails, 83% in state prisons), and most inmates (64% in jails, 70% in state prisons) report using drugs "regularly."

Statistics on the number of persons living with AIDS in the United States in 1997 were obtained from Centers for Disease Control and Prevention (CDC) surveillance reports.

HIV Infection (Non-AIDS. The data on the numbers of inmates with HIV infection (non-AIDS), based on BJS statistics, have a major limitation: they are compiled from state/federal prison systems with differing HIV testing policies. Only 16 state correctional systems and no major jail systems in the United States had mandatory HIV testing of new inmates in 1997. The majority of state prison and city or county jail systems had voluntary or on-request HIV testing, the aggregate results of which almost certainly underestimate true HIV seroprevalence, because some portion of HIV-infected inmates will not accept voluntary testing.[8]

Because of this potential underestimation, we developed a range of point prevalence rates for HIV infection (non-AIDS). The lower bound (1.45%) was based directly on BJS unadjusted survey data on the number of inmates with HIV infection (non-AIDS) in 1997.[3] The upper bound was obtained by adjusting upward by 50% (or by a specific adjustment factor, if available, for several state prison systems) the HIV seropositivity rates reported to BJS. Adjustment factors were based on comparisons between seropositivity rates found in voluntary testing and in blinded seroprevalence studies. In Maryland[14,15] and California,[16,17] for example, HIV seropositivity in blinded studies was 2 to 3 times that in voluntary testing. The size of the discrepancy depends on the degree of encouragement by prison systems of voluntary testing and on inmates' receptivity to testing. Some HIV-infected inmates may have difficulty accepting their status or fear discrimination, mistreatment, or breach of confidentiality. These circumstances vary across and even within systems.

For the 4 states that did not report 1997 seropositivity statistics to BJS, the BJS seropositivity rate for the state's region (Delaware, Indiana) or the state's 1996 reported data (Maine, Virginia) were adjusted upward by 50%.

Upward adjustments were applied to the federal prison system and to all but 4 of the states with voluntary testing. The 4 voluntary-testing states whose BJS figures were not adjusted were New York[18] and Connecticut,[19,20] where seropositivity rates reported to BJS were very close to those found in blinded seroprevalence studies, and Oregon and Wisconsin, where independent comparisons showed that seropositivity in voluntary testing was very similar to seroprevalence in blinded intake studies.[21,22] All of these calculations resulted in a national upper bound of 2.03%. The estimated range (1.45%–2.03%) was then applied to the national total of state/federal inmates.

Because no major jail systems in the United States had mandatory HIV testing and no breakdowns of AIDS and HIV (non-AIDS) cases among jail inmates were available, we applied the prevalence range for prisons to city and county jails. This choice seems justifiable on the basis of the population similarities described earlier.

We also compared the HIV prevalence range for city and county jails with an estimate obtained by a different method. Tabulations of data for the year 2000 from 32 counties participating in the NIJ's Arrestee Drug Abuse Monitoring Program indicate that a simple average of 8% of arrestees had injected drugs during the year before their booking. An analysis of DUF data from 20 counties showed that injection rates were falling by about 0.003 per year, so we assumed that 8.8% of arrestees injected drugs during 1997. This 8.8% was multiplied by the estimated national HIV seroprevalence among injection drug users, based on data from 96 US metropolitan areas (14%).[23] (A similar estimate of HIV seroprevalence among injection drug users, 12.7%, comes from 1992–1993 data from 16 US metropolitan areas.[24]) This calculation yielded an estimated HIV prevalence of 1.2% among jail inmates, similar to the lower-bound estimate based on BJS data (1.45%).

The number of persons in the total US population living with HIV (non-AIDS) was obtained by subtracting the number living with AIDS (from surveillance data) from a national estimate of 750 000 persons living with HIV infection. The 750 000 figure was based on 3 published estimates: 650 000–900 000 in 1992,[25] 630 000–897 000 in 1993,[26] and 800 000–900 000 in 1998.[27]

Data Sources and Estimation Methods for HCV

No national surveillance and no systematically collected national data are available on hepatitis among inmates. However, an indirect method of estimating HCV prevalence among inmates exists. According to the CDC, between 72% and 86% of injection drug users are infected with HCV[28] and an estimated 24% of state prison inmates have his-

tories of injection drug use.[29] Multiplying these 2 figures yields an estimated HCV prevalence among inmates of 17% to 21%, assuming that sharing of drug injection equipment is the primary risk factor for HCV among inmates. However, this estimate may be conservative given the prevalences of 30% to 41% found in system-specific studies in California,[17] Connecticut,[30] Rhode Island,[31] Washington,[32] and Maryland.[33]

Therefore, we used an inmate HCV prevalence range of 17% to 25% for this study, increasing the high end of the range from the indirect method (17%–21%) by 4% to account for the higher prevalences found in the system-specific studies. However, it is also important to recognize that most of these system-specific studies were conducted where HCV prevalence might be expected to be higher than nationally because of generally higher rates of injection drug use among inmates. An estimate of the total number of people in the United States with HCV infection was obtained from a population-based serologic survey.[34]

Data Sources and Estimation Methods for TB Disease

The primary source for prevalence estimates of TB disease among inmates was the ninth National Survey of HIV/AIDS, Sexually Transmitted Diseases (STDs), and TB in Correctional Facilities, conducted by Abt Associates Inc for the CDC and the NIJ in 1996–1997. The survey sought data on the number of inmates under treatment for active TB disease at the time the survey was completed, yielding a point prevalence estimate.

Separate weighted average prevalence estimates were calculated for prison and jail inmates based on data from 32 state/federal prison systems and 35 city/county jail systems.

The prevalence of TB disease in the total US population in 1997 was estimated using data from the CDC's TB registry reports and TB surveillance reports. The TB registry reports, which provided data on numbers of prevalent cases of TB disease, were discontinued after 1994. For the years since 1994, only incidence data on TB disease are available. Therefore, ratios of prevalence to incidence for 1992, 1993, and 1994 were calculated. The prevalence of TB disease during a given year was taken to be the sum of cases at the start of the year and cases added during the year. The incidence figure was taken from the CDC's TB surveillance reports.[35] The average prevalence-to-incidence ratio for these 3 years (.627) was applied to the 1997 incidence figure of 19 851[35] to obtain an estimated prevalence of TB disease in that year of 31 660.

RESULTS

AIDS and HIV Infection (non-AIDS)

National point prevalence estimates of inmates with confirmed AIDS and period prevalence estimates of releasees with confirmed AIDS in 1997 are presented in Table 1, broken down by prison and jail systems but combined for men and women. On June 30, 1997, more than 6300 state/federal prison inmates and more than 2800 jail inmates had AIDS.

Also, there were more than 2600 state/federal prison releasees and more than 36 000 jail releasees with AIDS in 1997. Thus, almost 16% of the estimated total of 247 000 persons living with AIDS in the United States in 1997[36] passed through a correctional facility that year (Table 3).

After applying our point prevalence range of 1.45% to 2.03%, there were between 17 000 and 25 000 state/federal prison inmates and between 8000 and 11 000 city/county jail inmates with HIV infection (non-AIDS) on June 30, 1997 (Table 2). Given the same prevalence range, between 112 000 and 157 000 people with HIV infection (non-AIDS) were released from US prisons and jails in 1997. This estimate suggests that between 22% and 31% of the approximately 503 000 people living with HIV infection (non-AIDS) in the United States in 1997 passed through a correctional facility that year (Table 3). Altogether, between 150 000 and 200 000 people with HIV infection passed through a US correctional facility in 1997, or between 20% and 26% of all people living with HIV in the nation that year (Table 3).

HCV

Table 3 presents national period prevalence estimates indicating that 17% to 25% of inmates and releasees were infected with HCV in 1997—303 000 to 446 000 inmates and 1.3 to 1.9 million releasees respectively. These estimates combine prison and jail systems. The estimate of 1.3 to 1.9 million releasees with HCV suggests that 29% to 43% of people with HCV infection in the United States passed through a correctional facility in 1997.

TB Disease

Table 3 presents point prevalence estimates of state/federal prison inmates (0.04%) and city/county jail inmates (0.17%) undergoing

TABLE 1—National Estimates of Inmates and Releasees With AIDS, 1997

Category	Inmates With AIDS, %, 1997[b]	Population, 1997[c]	Inmates With AIDS, 1997	Releasees, 1997[d]	Releasees With AIDS, 1997
State/federal prison systems[a]	0.5	1 218 256	6377	528 848	2 662
City/county jail systems	0.5	567 079	2835	7 246 337[e]	36 232
Total	0.5	1 785 335	9212	7 775 185	38 894

[a]Includes District of Columbia.
[b]Data from Maruschak.[3]
[c]Data from Gilliard and Beck.[10]
[d]Data from Bureau of Justice Statistics (BJS).[11]
[e]BJS estimate of 10 000 000 jail releasees divided by 1.38. See text ("Methods") for discussion.

TABLE 2—Inmates and Releasees With HIV Infection (Non-AIDS); United States, 1997

Category	Inmates With HIV (Non-AIDS), Range	Population	Inmates With HIV (Non-AIDS), Range	Releasees	Releasees With HIV (non-AIDS), Range
State/federal prison systems[a]	1.45[b]–2.03	1 218 256	17 658–24 798	528 848	6 984–10 560
City/county jail systems	1.45–2.03	567 079	8223–11 512	7 246 377	105 072–147 101
Total, both systems	1.45–2.03	1 785 335	25 881–36 310	7 775 185	112 056–157 661

[a]Includes District of Columbia.
[b]Data from Maruschak.[3]

TABLE 3—Estimated Burden of Infectious Disease Among Inmates and Releasees: United States, 1997

Condition	Prevalence Among Inmates, %		No. of Inmates With Condition	No. of Releasees With Condition	Total in US Population With Condition	Releasees with Condition as % of Total in US Population With Condition
	Prisons	Jails				
AIDS	0.5	0.5	9 212	38 894	247 032[a]	15.7
HIV infection (non-AIDS)	1.45–2.03	1.45–2.03	25 881–36 310	112 056–157 661	502 968	22.2–31.3
Total HIV/AIDS	. . .	. . .	35 093–45 522	150 950–196 555	750 000[b]	20.1–26.2
HCV (anti-HCV+)	17–25	17–25	303 507–446 338	1 321 781-1 943 796	4 500 000[c]	29.4–43.2
TB Disease	0.04	0.17	1 451	12 531	31 660[d]	39.6

Note. HCV = hepatitis C virus.
[a]Data from Centers for Disease Control and Prevention (CDC).[36]
[b]CDC estimate.
[c]Data based on prevalence estimate in McQuillan.[34]
[d]Estimated from CDC data.[35]

treatment for TB disease as of June 30, 1997—more than 1400 inmates. Applying the estimated prevalences among inmates to releasees indicates that more than 200 people who had active TB disease during 1997 were released from state/federal prisons in that year, whereas more than 12 000 people who had TB disease during 1997 were released from city/county jails that year. This application, in turn, suggests that almost 40% of the 31 000 persons who had TB disease in the United States in 1997 passed through a correctional facility that year.

DISCUSSION

Estimates of the numbers of inmates and releasees with selected infectious diseases and the percentages of the total burden of these diseases among persons passing through US correctional facilities are extremely high. These high estimates are driven principally by the large number of people being released from correctional facilities and especially from jails—jail releasees are estimated to number more than 7.2 million annually.

The estimates presented here are subject to several general and disease-specific limitations. Because they are based on incomplete data, the findings should be considered rough estimates of the burden of these infectious diseases in correctional populations. It is impossible to develop precise statistics, because a lack of systematic surveillance has resulted in few observations on which prevalence estimates could be based. Indeed, the lack of such data is strong evidence that surveillance must be undertaken or enhanced for this critical population and that surveillance data must be used to shape interventions.

The estimates are based primarily on data from state and federal prison systems. The application of the prison prevalence estimates to jail populations may be questioned, although some comparisons were presented which suggested that this is a reasonable strategy.

The prevalence estimates for AIDS and HIV infection are combined for males and females because most of the statistics on which the estimates are based do not provide breakdowns by sex. However, numerous system-specific studies have shown HIV seroprevalence to be higher among female than among male inmates.[37] The BJS 1997 survey[3] discussed previously found that, across all state and federal prison systems reporting HIV test results, 3.4% of female inmates were HIV-positive, and 2.2% of males.

Prevalence statistics for inmates by race and ethnicity are generally lacking, so it was not possible to develop estimates of disease burden by racial and ethnic group. However, the disproportionate incarceration rates experienced by African Americans and Latinos and the already disproportionate burden of the diseases under study among the same groups combine to produce a situation in which the vast majority of inmates and releasees with these infectious diseases are African American or Latino. In New York State correctional facilities, 48% of inmates diagnosed with AIDS in 1997 were Black and 45% were Hispanic, compared with the pro-

portions of these groups in the total population of the state of 18% and 14%, respectively.[38,39]

The study also relied on data reported by correctional systems that may not be based on standard case definitions and may be otherwise inaccurate or incomplete.

There are several limitations of the estimates of correctional populations on which the disease burden estimates are based. The methodology for estimating the number of unique jail releasees depended on data regarding frequency of arrests among regular drug users in 6 sites during a single year. Although these estimates seem reasonable based on other available evidence, they are unlikely to be a perfectly accurate representation of the rates among all arrestees nationally. Still, the actual arrest rates would have to be much higher to have a material effect on the conclusions of this study, which is unlikely to be the case.

The estimates may reflect some double counting between prison and jail populations. However, these duplications should not be great because prison terms are typically longer than 1 year; therefore, few people would be released from a jail and a prison during the same year.

Because the estimates for releasees are based on total numbers of persons released during a full year (period prevalence), an especially high figure for jails, they are much higher than the estimates for inmates which are based on the correctional population on a given day (point prevalence). Statistics on total numbers of individuals incarcerated during a full year are not available.

There are also several disease-specific limitations to consider. First, the estimates presented here are for 1997, when highly active antiretroviral therapy for HIV was only beginning to be introduced. Thus, in subsequent years, the numbers of inmates with AIDS diagnoses may have declined, as occurred in the total population, but this decline would probably have been counterbalanced by an increase in the number of persons living with HIV infection (non-AIDS). A second limitation is that the estimated range of inmate HCV prevalence presented here (17%–25%) is lower than prevalences found in virtually all studies of specific correctional systems, so these estimates may be at the low end. Third, although the estimates of TB disease are based on incomplete data, an independent check suggests that these data are reasonably accurate. According to CDC surveillance data, 728 TB cases were diagnosed among correctional inmates in 1997[35;] this figure is quite close to the figure of 768 inmates reported in the 1996–1997 NIJ/CDC survey to be undergoing treatment for active TB disease. However, the overall incidence of TB disease in the United States has declined since 1997. Finally, the estimate of releasees with TB disease was calculated by applying a point prevalence rate for inmates (i.e., the percentage of inmates under treatment for TB disease on a given day in 1997) to the total number of releasees during the full year of 1997. This does not mean that all of these releasees had TB disease at the time of their release from prison or jail. In fact, most of them probably did not have TB disease at the time of their release, because if properly treated, TB disease typically lasts only a short time. Nevertheless, the estimate indicates the congruence between populations likely to be incarcerated and those likely to have TB disease.

The estimates summarized in Table 3 demonstrate that the burden of infectious disease among correctional inmates and people being released from US correctional facilities is strikingly heavy. A disproportionate share of the burden of AIDS, HIV infection (non-AIDS), HCV infection, and TB disease is found among people who pass through correctional facilities. During 1997, about 3% of the US population spent time in a correctional facility. By contrast, between 16% and 43% of the burden of these infectious diseases was found in this relatively small segment of the population. The qualifications noted above, even if they all suggested some downward revision of the estimates, would not substantially change the estimates or the conclusions to be drawn from them.

The policy implications of these findings are clear. Correctional facilities are critical settings in which to provide interventions for the prevention and treatment of infectious diseases. Moreover, rates of many other health problems among inmates are also high. A recent report to Congress demonstrates that correctional populations are heavily burdened by STDs, current or chronic hepatitis B infection, chronic diseases, and mental illness.[40]

As noted, the bulk of infectious disease in correctional populations is found among persons passing through city and county jails. Because of the generally short lengths of stay of jail inmates—many of whom are being detained prior to trial as opposed to serving sentences and are often released after only a few hours in custody—and the rapid turnover of jail populations, mounting effective interventions in jails is particularly challenging. However, it can be done. The public health model of correctional health care developed at the Hampden County, Massachusetts, Correctional Center gives evidence that a jail can provide high-quality prevention, diagnostic, and treatment services to a large and fluid inmate population.[41] Correctional interventions of this kind stand to benefit not only inmates themselves and their families and partners, but also the public health of the communities to which the vast majority of inmates return. ■

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Contributors

T.M. Hammett was principal investigator of the study and lead author of the paper; M P. Harmon conducted most of the data analyses; and W. Rhodes contributed important analytic concepts and designed and carried out several specific analyses.

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